

STATE OF CALIFORNIA

Specification for Profilable Thermoplastic Traffic Striping Material, White and Lead-Free Yellow

1.0 SCOPE

This specification covers a hot-melt, retroreflective thermoplastic pavement marking material that is suitable for producing durable, profiled traffic stripes and pavement markings on Portland cement concrete or asphalt concrete pavements. The material is heated and applied to road surfaces in a molten state using a mechanical applicator. Immediately after application to the pavement, glass beads are applied and a profiled surface is imparted to the hot thermoplastic stripe using various mechanical means. Upon cooling to normal pavement temperatures, the resulting traffic striping shall be retroreflective, firmly bonded to the pavement and have a surface profile that matches the required dimensions. The profiled stripe shall be resistant to deformation by traffic.

2.0 APPLICABLE SPECIFICATIONS

The following specifications, test methods and standards in effect on the opening date of the Invitation for Bid form a part of this specification where referenced.

- California Test Method (CTM); No. 423 and No. 660 (latest revision).
- California Department of Transportation, Standard Specifications, July 1999.
- Federal Standard Designation: No. 595b, color #33538
- American Association of State Highway and Transportation Officials, (AASHTO) Designation: M 247, AASHTO Designation: T 250
- American Society for Testing and Materials, (ASTM) Designations; D 476, D 2794, D 3335, D 3718, D 4563, D 4764, D 5380, D 5381, D 6359, D 6628, E 11, E 28, E 313, E 1710, and G 155.
- Commission International de l'Eclairage (C.I.E.) 1931 Chromaticity Diagram.
- California Code of Regulations Designation: Title 22.

3.0 REQUIREMENTS

3.1 Composition:

The thermoplastic material shall be composed of 100% solids. The binder shall consist of synthetic hydrocarbon or alkyd thermoplastic resins which are homogeneously blended together with all necessary pigments, fillers, glass beads and additives to produce a traffic striping material that meets the requirements as specified herein. All thermoplastic material shall be free from; lead, chromium, cadmium, barium and other toxic metals.

3.1.1 White Material:

White thermoplastic shall contain a minimum of 10% (by weight) titanium dioxide pigment meeting ASTM Designation: D476 Type II (Rutile). The titanium dioxide content will be determined using ASTM Designations; D 4563, D 4764, D 5380 or other x-ray diffraction analysis method.

3.1.2 **Lead-Free Yellow Material:**

Lead-Free (L/F) yellow thermoplastic shall contain proper amounts of C.I. Pigment Yellow 83 (opaque version) and titanium dioxide (Rutile) to produce a material that has a weather-fast and heat stable yellow color which meets the requirements as stated herein. Other pigments may be added to achieve these color requirements. The L/F yellow thermoplastic material shall appear yellow during both daytime and nighttime conditions when applied with drop-on glass beads.

3.1.3 **Other Ingredients:**

The remainder of the thermoplastic composition shall be determined by the manufacturer - within the constraints of the requirements below. It shall be the manufacturer's responsibility to produce a thermoplastic material containing the necessary plasticizers, antioxidants, and other additives so that the thermoplastic will retain its color, viscosity and all other properties as specified herein. In addition to being essentially lead and chromium free, the thermoplastic shall not contain any hazardous materials at levels that would cause the thermoplastic to be classified as a hazardous waste under Title 22, Division 4, section 66261.20 of the California Code of Regulations.

3.2 **Form:**

The thermoplastic material shall be supplied in either block or granular form as requested in the purchase order.

3.3 **Application Type:**

The thermoplastic material shall be formulated for profiled application and shall have suitable viscosity and thixotrophy to allow proper application at the recommended temperatures.

3.4 **Characteristics of the Finished Thermoplastic:**

Use California Test Method No. 423 (CTM 423) unless otherwise specified. The melting and stirring apparatus (see Figure 8) differs slightly from that shown in CTM 423. Once the material is melted, the speed of the mixing blade should be at least 160 revolutions per minute.

3.4.1	Glass Bead Content, intermixed, meeting AASHTO Designation: M 247 Type I, percent by weight, minimum, CTM 423 (Part 4).	<u>White</u>	<u>L/F Yellow</u>
		30	30
3.4.2	Binder Content, percent by weight, minimum.	<u>White</u>	<u>L/F Yellow</u>
		18	18

CTM 423 (Part 3).

3.4.3	Inert Fillers, insoluble in hydrochloric acid, percent passing a sieve with openings of 150µm, percent by weight, minimum, ASTM Designation: E 11.	<u>White</u> 100	<u>L/F Yellow</u> 100
3.4.4	Titanium Dioxide (Rutile) Pigment meeting ASTM Designation D476 Type II, analyze titanium dioxide content using ASTM Designation: D 4563, D 4764, D 5380 or other x-ray diffraction method, percent by weight, minimum.	<u>White</u> 10	<u>L/F Yellow</u> ---
3.4.5	Specific Gravity, maximum, CTM 423 (Part 5).	<u>White</u> 2.15	<u>L/F Yellow</u> 2.15
3.4.6	Ring and Ball Softening Point, CTM 423 (Part 6), ASTM Designation: E 28.	<u>White</u> 93-121°C	<u>L/F Yellow</u> 93-121°C
3.4.7	Perform the remaining tests on the material after 4 hours heating with stirring at $218 \pm 2^{\circ}\text{C}$. This 4 hours includes time required (~1 hr.) for melting and temperature stabilization of the 6 kg. sample.		
3.4.7.1	Tensile Bond Strength to an unprimed abrasive blasted Portland cement concrete brick, 3.2 mm thick film draw down at 218°C , tested at $25 \pm 2^{\circ}\text{C}$, MPa, minimum, CTM 423 (Part 7).	<u>White</u> 1.24 MPa	<u>L/F Yellow</u> 1.24 MPa
3.4.7.2	Brookfield Thermosel Viscosity, Spindle SC4-27, 2.5 rpm at 218°C , Pa•s, minimum, CTM 423 (Part 8).	<u>White</u> 30	<u>L/F Yellow</u> 30
3.4.7.3	Viscosity Shear Ratio, minimum, Use CTM 423 (Part 8) as in 3.4.7.2 above except determine Brookfield Thermosel Viscosity at both 0.5 rpm and 2.5 rpm (at 218°C). Calculate Viscosity Shear Ratio as: Viscosity Shear Ratio = $\frac{\text{viscosity at 0.5 rpm}}{\text{viscosity at 2.5 rpm}}$	<u>White</u> 3	<u>L/F Yellow</u> 3
3.4.7.4	Impact Resistance, 3.2 mm thick film	<u>White</u> 0.58	<u>L/F Yellow</u> 0.58

draw down at 218°C on an unprimed abrasive blasted Portland cement concrete brick, 0.90-kg male indenter 15.9 mm diameter, no female die. Test at $25 \pm 2^\circ\text{C}$, kilogram force•meter, with no chips, cracks or bond loss, minimum CTM 423 (Part 9), ASTM Designation D 2794.

3.4.7.5	Daylight Luminous Reflectance CTM 423 (Part 11) except use a BYK-Gardner “Color-Guide” Spectrophotometer. Follow the manufacturer’s instructions to obtain the Reflectance or “Y” value. Set-up the spectrophotometer for 2° Observer and Illuminant “C” measurement conditions.	<u>White</u> 80 Minimum	<u>L/F Yellow</u> 42 to 59
3.4.7.6	Yellow Color shall match Federal Standard Designation: No. 595b, color #33538 and shall lie within the following chromaticity limits “colorbox” defined by plotting the following four (x,y) pairs on a C.I.E. 1931 Chromaticity diagram; (x1,y1) = (0.5125, 0.4866) (x2,y2) = (0.4865, 0.4647) (x3,y3) = (0.5000, 0.4416) (x4,y4) = (0.5348, 0.4646) Reflectance(Y) shall be between 42 and 59. Measurement conditions = 2°Observer/illuminant “C”. Test according to CTM 423 (Part 10) except use a BYK-Gardner “Color-Guide” Spectrophotometer to measure the color. Follow the manufacturers instructions to obtain the (x,y) chromaticity coordinates. See attached Yellow Color chart (Figure 9).	<u>White</u> ---	<u>L/F Yellow</u> Pass
3.4.7.7	Yellowness Index, maximum Follow CTM 423 (Part 11) except use a BYK-Gardner “Color-Guide” Spectrophotometer to measure the Yellowness Index of the white thermoplastic using the ASTM Designation: E313 mode.	<u>White</u> 10	<u>L/F Yellow</u> ---
3.4.7.8	Color Stability after Accelerated Weathering, ASTM Designation: G 155, Table X3.1, Cycle 1, 500 hours total exposure time. Prepare sample by dipping a sheet aluminum panel into the molten thermoplastic and removing it to obtain a 1.5 to 3mm coating thickness of thermoplastic on the panel. Place the panel in the weathering apparatus for 500 hrs.		

After accelerated weathering, measure the Yellow Color or Yellowness Index as in section 3.4.7.6 or 3.4.7.7 above. Material must meet the color stability requirements below after this exposure.

	<u>White</u>	<u>L/F Yellow</u>
White - Yellowness Index, maximum	20	---
Yellow - Measured chromaticity coordinates must fall within a "colorbox" defined by plotting the following four (x,y) pairs on a C.I.E. 1931 Chromaticity diagram. (x1, y1) = (0.5125, 0.4866) (x2, y2) = (0.4650, 0.4466) (x3, y3) = (0.4750, 0.4251) (x4, y4) = (0.5348, 0.4646)	---	Pass

	<u>White</u>	<u>L/F Yellow</u>
3.4.7.9 Hardness, Shore A-2 Durometer, measure according to CTM 423 (Part 12) except condition the sample for 2 hrs. in a 46.1°C water bath before measuring the Hardness. The Durometer is also conditioned at 46.1°C in a forced air oven. Remove the sample from the water bath and quickly place the Durometer on the sample while starting a stopwatch. Record the Hardness after 15 seconds. The total weight of the Durometer shall be 2000 grams.	20 to 75	20 to 75
3.4.7.10 Abrasion Test Use 400 g of graded glass beads between 600 and 850 µm diameter and an air pressure of 152 kPa to sandblast the sample in 4 different areas according to CTM 423 (Part 14), total weight loss, grams, maximum.	<u>White</u> 10	<u>L/F Yellow</u> 10
3.4.7.11 Lead, mg/kg in thermoplastic, maximum, ASTM D3335	<u>White</u> 20	<u>L/F Yellow</u> 20
3.4.7.12 Chromium, mg/kg in thermoplastic, maximum, ASTM D3718	<u>White</u> 5	<u>L/F Yellow</u> 5
3.4.7.13 Initial Retroreflectivity of applied thermoplastic striping (with glass beads), $\text{mcd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$, minimum	<u>White</u> 250	<u>L/F Yellow</u> 175

The thermoplastic shall produce delineation and pavement markings that have the required minimum level of retroreflectivity when applied with drop-on glass beads. Drop-on glass beads shall be uniformly applied at a minimum rate of 4-kg of beads per 10 square meters of

thermoplastic. The retroreflectivity shall be measured as specified in ASTM D6359-99 using a retroreflectometer meeting ASTM E1710-97.

3.4.7.14 Color after Application

The daytime color of the applied white and yellow thermoplastic traffic stripes and pavement markings (with drop-on beads) shall meet the color requirements in section 3.4.7.8 (Color Stability after Accelerated Weathering). The color shall be measured within 60 days of application using a portable BYK-Gardner “Color-Guide” Spectrophotometer.

3.5 Other Requirements:

3.5.1 Slump Test

3.5.1.1 Purpose:

The ability of the applied profiled material to resist leveling while hot is described below.

3.5.1.2 Summary:

Using a specialized slump test die box (Figure 4), a stripe of the molten thermoplastic material is extruded onto a concrete brick leaving profiled grooves in the thermoplastic surface. The widths of these grooves are measured after the material has cooled to determine if excessive leveling has occurred.

3.5.1.3 Apparatus:

A die box shall be formed that is enclosed on three sides utilizing 3.2 mm X 50.8 mm flat steel stock (Figure 4). The parts shall be welded together to form a screed box. One edge of this box shall have gaps (openings) milled as shown in Figure 4. These gaps will produce a profiled thermoplastic line to be extruded when the die box is moved across the concrete brick. The rear of the die shall be joined together using a piece of 12.7 mm diameter round steel stock. A handle can be affixed in order to move the die box (Figure 4). A forced air oven maintained at $218^{\circ}\text{C} \pm 2^{\circ}\text{C}$, a ladle and a abrasive-blasted concrete brick as described in California Test Method Designation No. 423 (Part 7) will also be needed. Measurement of the width of the profiled groove can be done using a caliper.

3.5.1.4 Procedure:

The specialized die box (Figure 4) is placed in a $218^{\circ}\text{C} \pm 2^{\circ}\text{C}$ oven and allowed to equilibrate to oven temperature. The abrasive-blasted concrete brick is placed on a sturdy workbench and allowed to reach $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$. The melted thermoplastic sample from the tests in section 3.4.7 is maintained at 218°C for 2 to 4 hours with stirring from the time the sample becomes completely melted.

Working quickly to avoid excessive cooling, remove the hot die box from the oven and place it on one end of the concrete brick (Figure 1). Quickly ladle approximately 350 gm of the hot thermoplastic sample into the die box reservoir (Figure 1). Draw the die box along the 178 mm length of the concrete brick in a smooth motion requiring approximately 3 seconds (Figure 2). Continue drawing the die box along and off the edge of the concrete brick (Figure 2). This should form a profiled stripe of thermoplastic on the face of the brick. Allow the thermoplastic to cool to room temperature and measure the width of the profiled grooves in the thermoplastic stripe using a caliper to determine the distance between the vertical faces of each groove at the bottom of the

groove (Figure 3). Measure this distance at 3 different places in each groove of the profiled stripe. The average distance between the vertical faces of a passing sample shall be greater than 5.00 mm.

3.5.2 Compression Test

3.5.2.1 Purpose:

The ability of the thermoplastic material to resist deformation, while under a load and at typical hot pavement temperatures, is described below.

3.5.2.2 Summary:

The hot thermoplastic material is cast in a rectangular mold and allowed to cool. The sample is removed from the mold and placed in an oven with a static load on top of the sample. After 4 hours the deformation of the sample is measured.

3.5.2.3 Apparatus:

A rectangular steel form shall be fabricated from 15.9 mm square bar stock steel (Figure 5). The form shall be assembled at the corners with socket head cap screws for easy disassembly. The inside dimensions of the form shall be 40.6 mm X 99.1 mm. Also required are; a standard 2" X 3.5" X 8" red clay construction brick weighing 2500 gms \pm 200 gms, a 200 mm X 200 mm piece of 6 mm thick Masonite board, a forced air oven maintained at 85°C \pm 2°C, silicone mold release spray and silicone release paper.

3.5.2.4 Procedure:

Assemble the mold and spray the interior surfaces with the mold release spray. Center the mold on the Masonite hardboard and place on a level surface. Fill the mold slightly more than level full with hot thermoplastic material heated to 218°C \pm 2°C in accordance with section 3.4.7. Strike off the excess thermoplastic to form a flat surface on the top of the sample. Allow the sample to cool for at least 4 hours before removing the mold. Leave the molded sample on the Masonite board. Measure the surface area of the top face of the rectangular thermoplastic sample. Cover the top of the sample with a piece of silicone release paper slightly larger than the sample itself. Place the large face of the brick squarely on top of the molded sample, centering the brick on top of the sample (Figure 6). Place the Masonite board, thermoplastic sample, silicone release paper and brick in an 85°C forced air oven for 4 hours. At the end of 4 hours remove the sample from the oven and remove the brick from the sample. Allow the sample to cool to room temperature and measure the surface area of the top face of the thermoplastic sample (Figure 7). The surface area shall increase by no more than 10% above the initial surface area.

3.5.3 Workmanship:

The materials' ingredients (resins, pigments, glass beads, fillers and additives) shall be homogeneously blended. The finished product shall be uniform from bag to bag. The melted thermoplastic material shall have no indications of resin separation or incompatibility of resins when melted or after cooling. The material shall be free from all; dirt, water, foreign matter, and other deleterious substances capable of clogging; screens, valves, pumps and other striping apparatus. The thermoplastic material shall be of such composition that it will not bleed, stain, or discolor when applied to pavements.

3.5.4 Shelf Life:

The material shall maintain the requirements of this specification for a minimum period of one (1) year from the date of manufacture. Any materials failing to do so shall be replaced at the expense of the manufacturer. Ordered thermoplastic shall be no more than 120 days old (based on date of manufacture) upon delivery to a Department of Transportation Maintenance facility. The date of manufacture shall be clearly marked on each bag of thermoplastic.

3.5.5 Applicability:

The thermoplastic material shall completely melt to a homogeneous fluid that is free of debris. The molten thermoplastic material shall be readily applied at temperatures between 204°C and 232°C. The material shall have suitable viscosity and thixotrophy to allow proper profiled application. The applied stripe shall retain its profiled height and shape and shall not flow or become deformed while cooling or when bearing traffic. Upon application to the pavement, the thermoplastic material shall be sufficiently tack-free to carry traffic; in not more than 2 minutes when the pavement surface temperature is 16°C, and in not more than 10 minutes when the pavement surface temperature is 54°C.

3.5.6 Air Pollution Compliance:

This material shall comply with all applicable air pollution control rules and regulations. The thermoplastic material shall not emit fumes that are toxic or injurious to persons or property when it is heated to application temperature. The material shall not emit excessive smoke during heating or application.

4.0 QUALITY ASSURANCE PROVISIONS

4.1 Inspection and Sampling:

All thermoplastic material intended for use by the California Department of Transportation (the Department) must be sampled, tested and approved by the Transportation Laboratory **before** shipment.

Manufacturers within the State of California must contact the nearest Department Inspection Office (see section 6.4) to have lots of thermoplastic sampled and tagged prior to sending samples to the Transportation Laboratory for testing. The address of the Transportation Laboratory is listed in section 6.4.

Manufacturers outside the State of California shall take representative samples of each lot of thermoplastic and ship the samples to the Transportation Laboratory. Two (duplicate) 6 kg. samples of each lot of thermoplastic are required to be sent to the Transportation Laboratory for testing.

A lot shall consist of a batch or consecutive batches of thermoplastic manufactured on the same day using the same formulation. A batch shall be that amount of thermoplastic that was manufactured and packaged in a single operation. Thermoplastic from the same lot shall be palletized, shrink-wrapped, labeled with the manufacturer's lot and batch

numbers (on each pallet) and batch number (on each bag) and stored in a common area to facilitate random sampling of the entire lot by the Inspector. A lot shall be more than 900 kg and shall be less than 20,000 kg. of thermoplastic.

Manufacturers must submit the following information along with the two representative 6 kg samples of each lot for testing.

1. State Specification number (#PTH-02PROFILE).
2. Manufacturer's Product number
3. Color; (White or Lead-Free Yellow) and kgs. represented by samples.
4. Identification numbers of batches comprising the lot, and lot number.
5. Date of manufacture.
6. Form (block or granular).
7. Binder Type (hydrocarbon or alkyd).
8. Sampling method (splitting, thieving, quartering, random bag, etc.).
9. Purchase Order or Contract number.

A manufacturer's test report shall also be included with the representative duplicate samples of each lot sent to the Transportation Laboratory. The following information shall be included in the manufacturer's test report:

- Hardness
- Binder Content
- Glass Bead Content
- Daylight Luminous Reflectance
- Yellow Color (for yellow only)
- Yellowness Index (for white only)

The samples and above information shall be sent to the Transportation Laboratory at the address listed in section 6.4. A Certificate of Compliance (see section 6.1) shall accompany the samples.

Once the Transportation Laboratory approves a lot of thermoplastic, the manufacturer will be notified that the lot is approved for shipment.

When shipments of the approved lots/batches of thermoplastic are made to a Department of Transportation Maintenance facility, the manufacturer shall fax the following information to the Transportation Laboratory within 48 hours of the shipping date. Out of State manufacturers shall also fax the following information to the Transportation Laboratory whenever shipments of approved lots/batches are shipped to warehouses, resellers, or Contractors within the State of California.

- State Specification number (#PTH-02PROFILE).
- A list of each delivery locations and delivery dates.
- Name and phone number of contact person(s) at the delivery location(s).

- Colors, batch/lot numbers and quantity of material comprising shipment.
- Purchase Order number or Contract number and date that order was received.

This information shall be faxed to: Transportation Laboratory, Chemical Testing Section, 5900 Folsom Blvd., Sacramento, CA 95819-0128, attn.: Lisa Dobeck, Fax (916) 227-7168.

The Department of Transportation reserves the right to take random samples of lots/batches of thermoplastic destined for use by the Department, at the manufacturer's facility. Sampling may also be done at the Contractor's warehouse or jobsite. If requested by the Inspector, batch tickets must also be provided for batches of thermoplastic produced for the Department.

The Department of Transportation also reserves the right to retest any batch/lot of thermoplastic after delivery. Results from such retesting shall prevail over all other tests and may be the basis of rejection. Material not meeting the specification shall be removed and replaced by the supplier at their expense, including all costs for handling, retesting and shipping.

4.2 **Testing:**

All tests shall be performed according to the specified test methods, latest revision. Qualitative and quantitative analysis may also be performed by other methods of analysis, at the option of the Department. The manufacturer shall maintain a laboratory sufficiently staffed and equipped so as to maintain the quality of the product as called for in these specifications.

5.0 **PREPARATION FOR DELIVERY**

5.1 **Packaging:**

5.1.1 **Block Form:**

The thermoplastic material shall be packaged in suitable containers to which it will not adhere nor interact during shipment and storage. The blocks of cast thermoplastic material shall be approximately 900 by 300 by 50 mm and shall weigh approximately 22.7 kg. The containers shall be palletized as specified in the contract or purchase order.

5.1.2 **Granular Form:**

The thermoplastic material shall be packaged in meltable bags which are compatible with the thermoplastic and which weigh approximately 22.7 kg when filled. The containers must have sufficient strength and be properly sealed to prevent breakage and leakage during normal handling. The bags shall be shrink-wrapped to reduce shifting of the bags on the pallet and shall be palletized as specified in the contract or purchase order.

5.2 **Markings:**

Each individual unit/container of product shall be labeled. This label shall include: State Specification number (#PTH-02PROFILE), color, type of binder, manufacturer's name

and address, date of manufacture and batch number. Lead-free yellow materials shall be marked "Lead-Free". All markings on containers shall be legible and permanent. Markings shall not smear or rub off container. Containers failing to meet marking requirements will not be accepted.

The containers and labeling shall meet all applicable US Department of Transportation and Interstate Commerce Commission regulations. Concerning the content, each container shall be labeled with such warnings or precautions as are required by Local, State and Federal laws and requirements.

6.0 NOTES

6.1 Certificates of Compliance:

The manufacturer of thermoplastic materials shall furnish the Engineer with a Certificate of Compliance in conformance with the provisions of the California Department of Transportation Standard Specifications, July 1999, section 6-1.07, "Certificate of Compliance." The Certificate shall also include a list, by title and section, of all applicable State and Federal packaging and labeling laws and a statement that all requirements have been met. Certificates of Compliance shall be sent along with each delivery of thermoplastic and also with samples sent to the Transportation Laboratory for testing.

6.2 Material Safety Data Sheets:

Material Safety Data Sheets (MSDS's) shall be provided by the manufacturer with each delivery of thermoplastic. These MSDS's shall include health hazard information on the material when it is heated to application temperature (218°C).

6.3 Patents:

The Contractor shall assume all costs arising from the use of patented; materials, equipment, devices or processes used on or incorporated in the work, and further agrees to indemnify and save harmless the State of California and its duly authorized representatives from all suits at law or action of every nature for or on account of the use of any patented; materials, equipment, devices or processes.

6.4 Contact Information:

Please call the nearest California Department of Transportation Inspection Office (see below) to submit samples for testing. Once samples are tagged by an Inspector, they should be sent to:

California Department of Transportation
Transportation Laboratory – Chemistry Branch
5900 Folsom Blvd.
Sacramento, CA 95819
Attention: Andy Rogerson
Fax: (916) 227-7168

To arrange for samples to be tagged by an Inspector, contact one of the Inspection Offices below;

LA Area Quality Assurance and Source Inspection
12501 East Imperial Highway – 4th Floor
Norwalk, CA 90650-3136
Phone: (562) 863-0303 or (562) 863-2553
Fax: (562) 863-3308

Bay Area Quality Assurance and Source Inspection
4240 Hollis Street, Suite 300
Emeryville, CA 94608
Phone: (510) 450-7765
Fax: (510) 601-5337

Northern California Quality Assurance and Source Inspection
Transportation Laboratory
5900 Folsom Blvd.
Sacramento, CA 95819
Phone: (916) 227-7258
Fax: (916) 227-7117

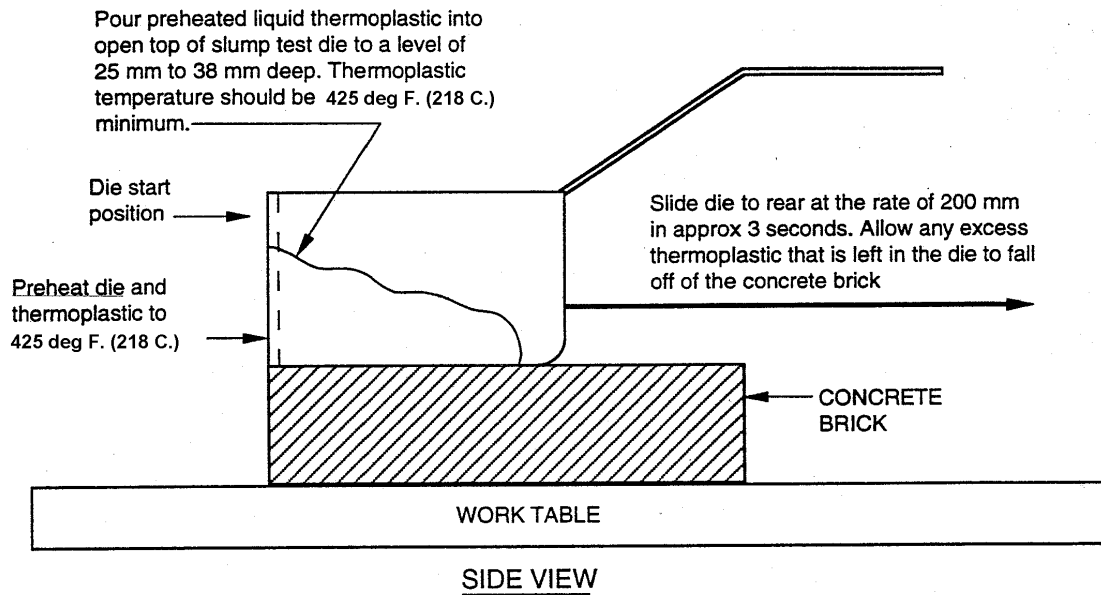
Fresno Quality Assurance and Source Inspection
2510 S. East Street. Suite 400
Fresno, CA 93706
Phone: (559) 445-6310
Fax: (559) 488-4343 or (559) 488-4165

CALIFORNIA DEPARTMENT OF TRANSPORTATION
SPECIFICATION #PTH-02PROFILE
(APRIL 2003)

PROFIED THERMOPLASTIC SLUMP TEST PROCEDURE

(N.T.S.)

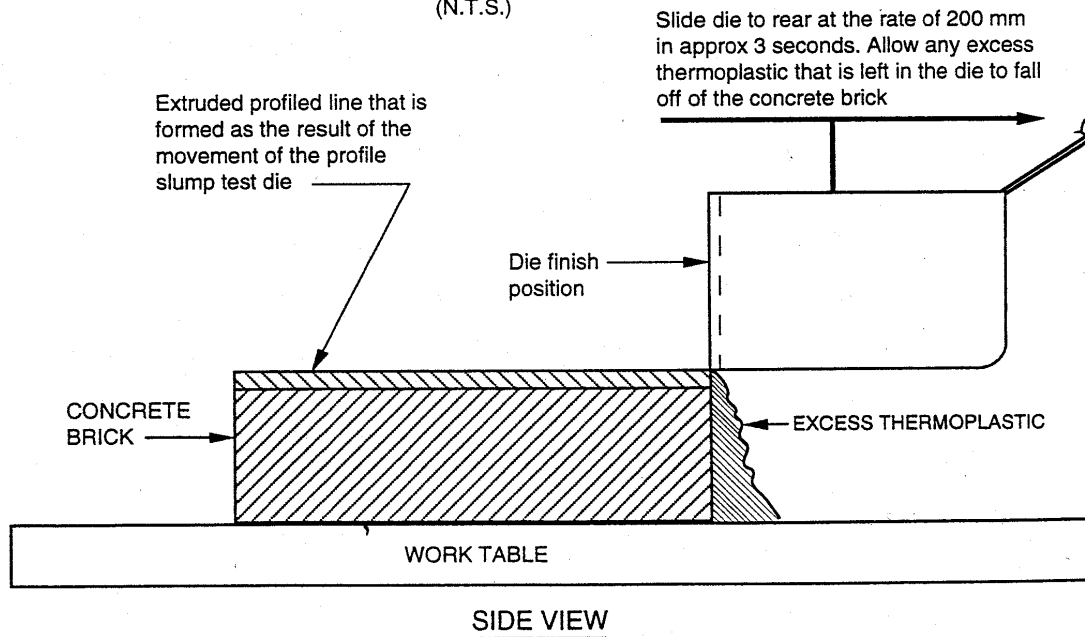
FIG. 1



PROFIED THERMOPLASTIC SLUMP TEST PROCEDURE

(N.T.S.)

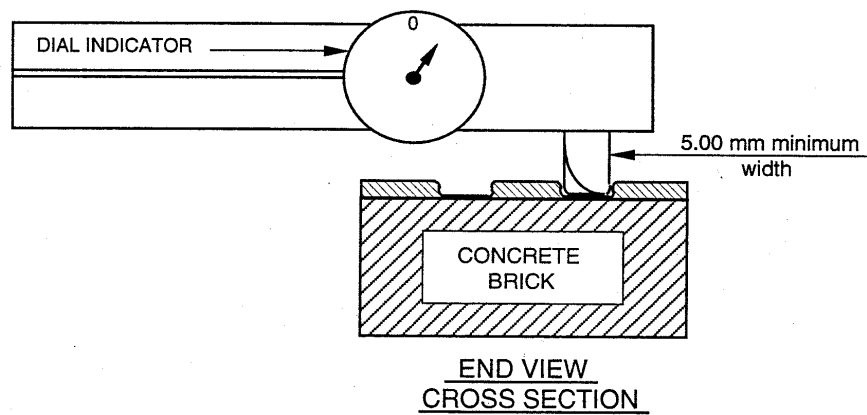
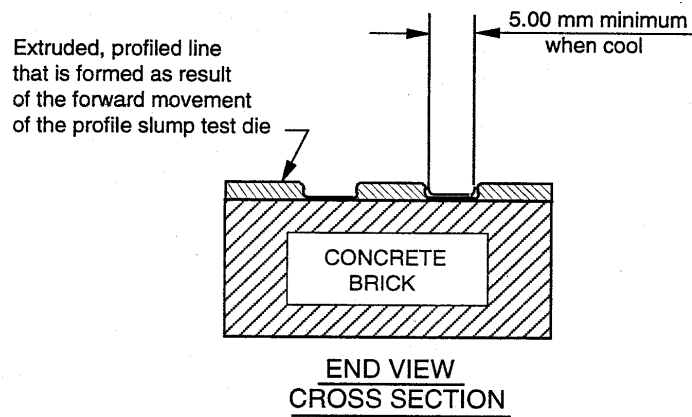
FIG. 2



**PROFIED THERMOPLASTIC
SLUMP TEST PROCEDURE**

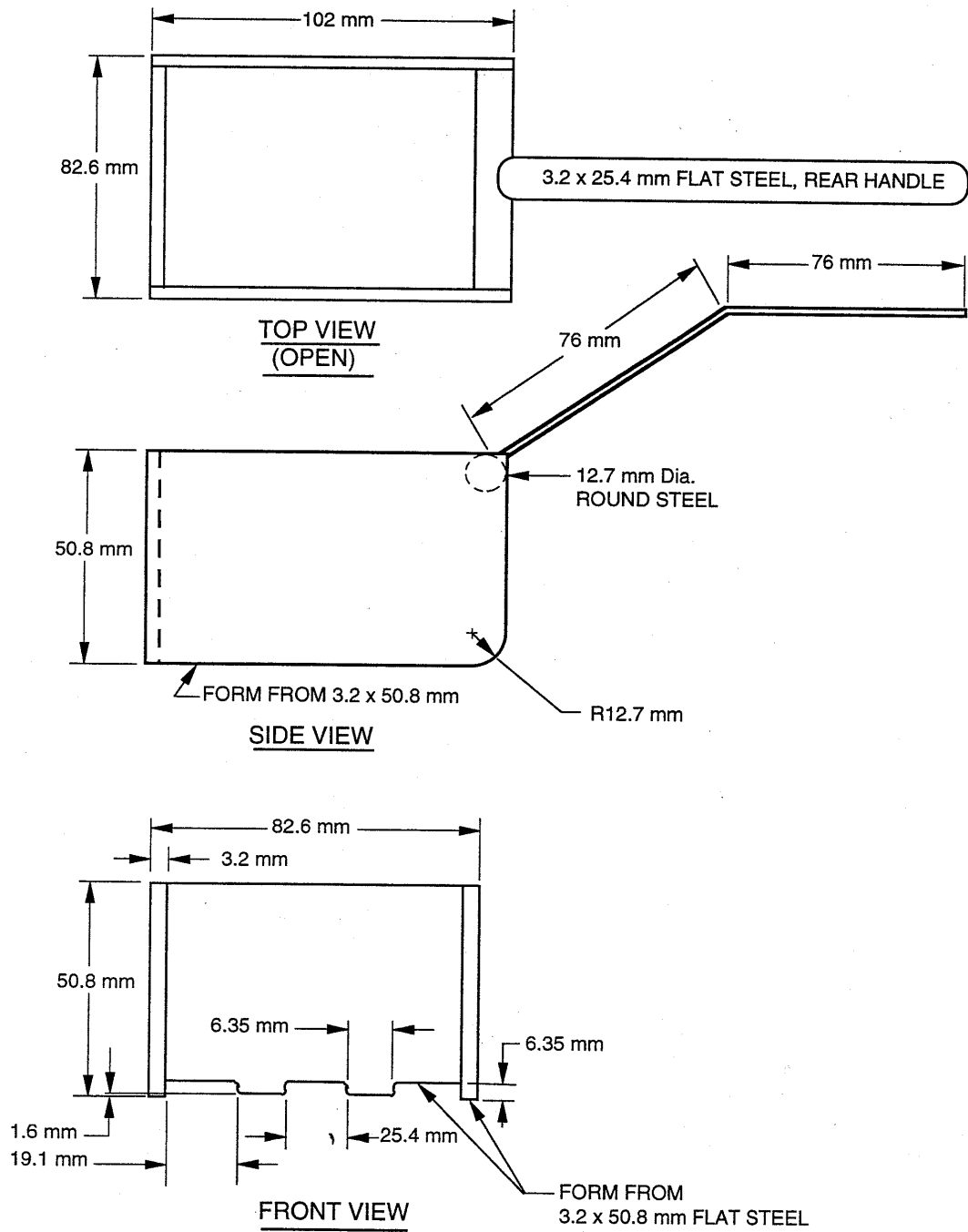
(N.T.S.)

FIG. 3



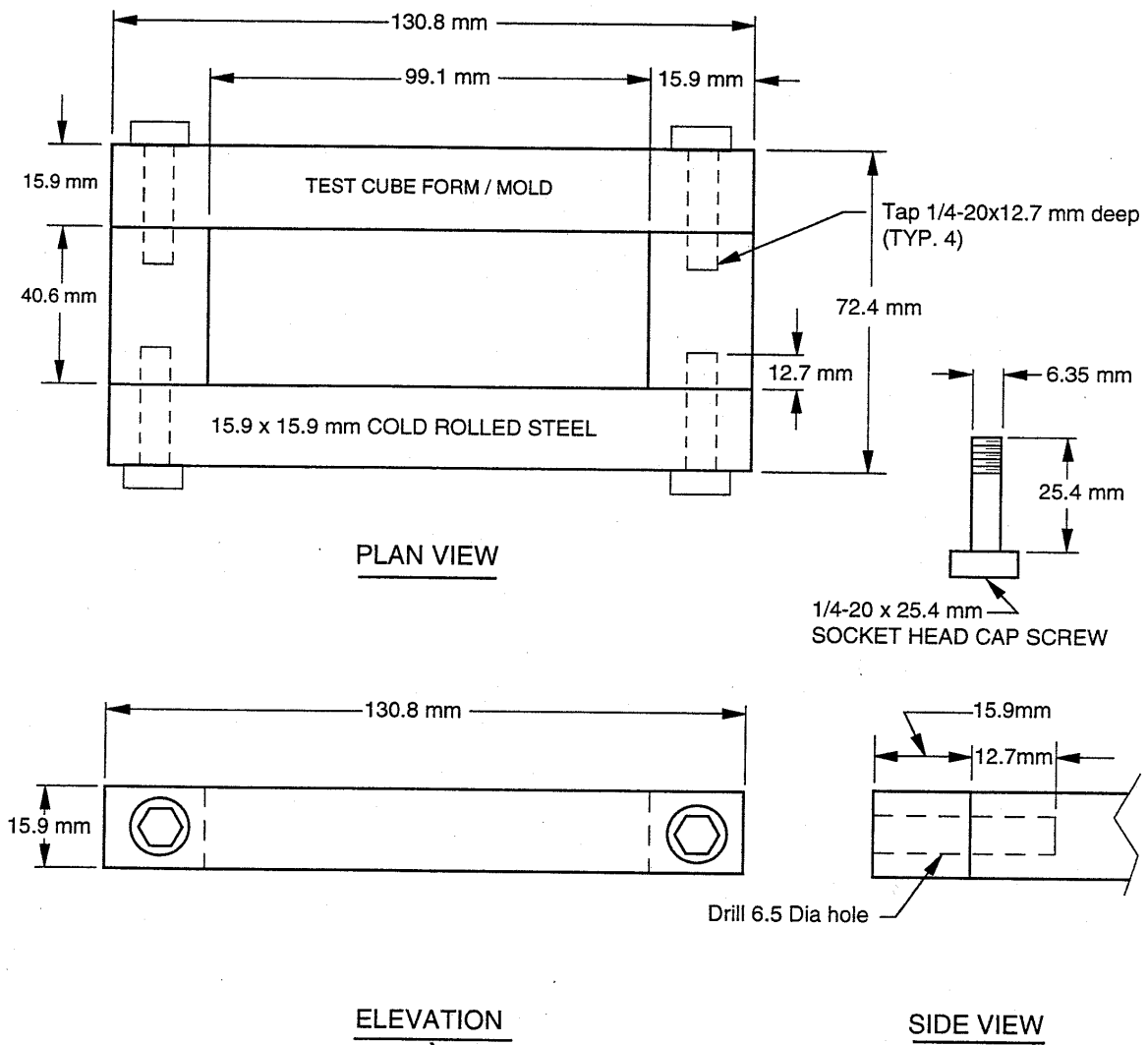
**PROFIED THERMOPLASTIC
SLUMP TEST PROCEDURE**
(N.T.S.)

FIG. 4



**PROFIED THERMOPLASTIC
COMPRESSION TEST PROCEDURE**
(N.T.S.)

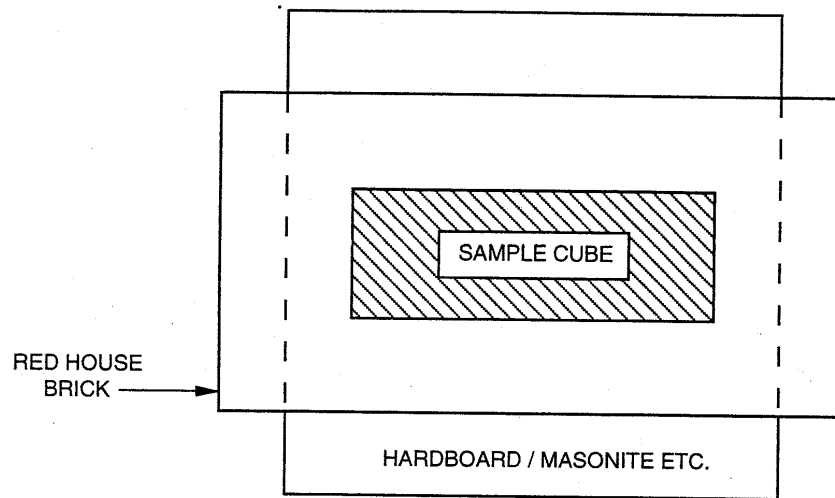
FIG. 5



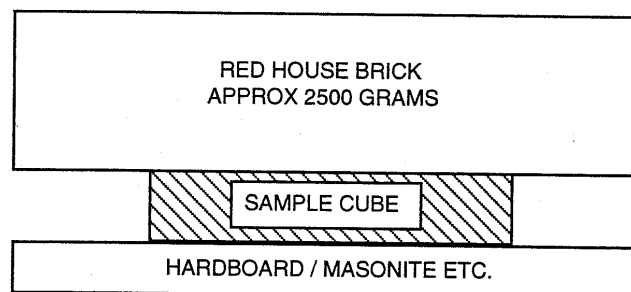
**PROFIED THERMOPLASTIC
COMPRESSION TEST PROCEDURE**

(N.T.S.)

FIG. 6



PLAN VIEW

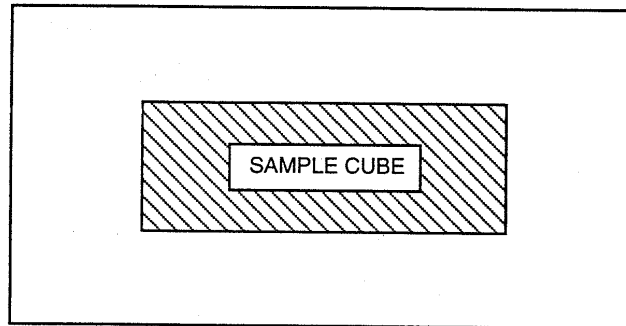


SIDE VIEW

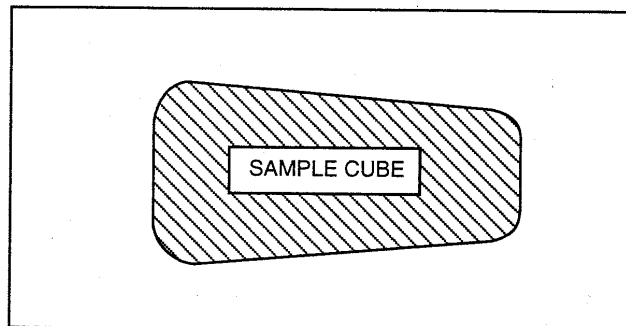
**PROFILED THERMOPLASTIC
COMPRESSION TEST PROCEDURE**

(N.T.S.)

FIG. 7



AFTER TEST-TYPICAL PASS



AFTER TEST-TYPICAL FAIL



Melting/Stirring Equipment



Melting a Sample

Thermoplastic Melting and Stirring Equipment List

- Glas-Col, heating mantle, cat. #100D-DH098BC
- Arrow Engineering Co., air-powered stirrer motor, Model GG
- Arrow Engineering Co., Jacobs chuck adapter for 3/8" motor shaft, Part no. Jacobs #375
- Arrow Engineering Co., stirrer shaft 3/8" diam., 12" long, Part no. S-316-12
- Arrow Engineering Co. stirrer propeller, 5.25" diam., Part no. VPP316-52 (2 needed)
- Arrow Engineering Co. stirrer support stand with 5/8" diam. rod, Part no. ASE-625
- Arrow Engineering Co. power hold universal clamp, Part no. PHC-625
- Omega Engineering process temperature controller, Model #BS5001J1
- Omega Engineering, stainless steel sheathed thermocouple, Part no. TJ36-ICSS-18G-12
- 1-gal metal paint can with welded seam
- Lid to fit 1-gal. paint can (modified to allow passage of stirrer and thermocouple)
- Compressed air supply, ~80 psi

FIG. 8

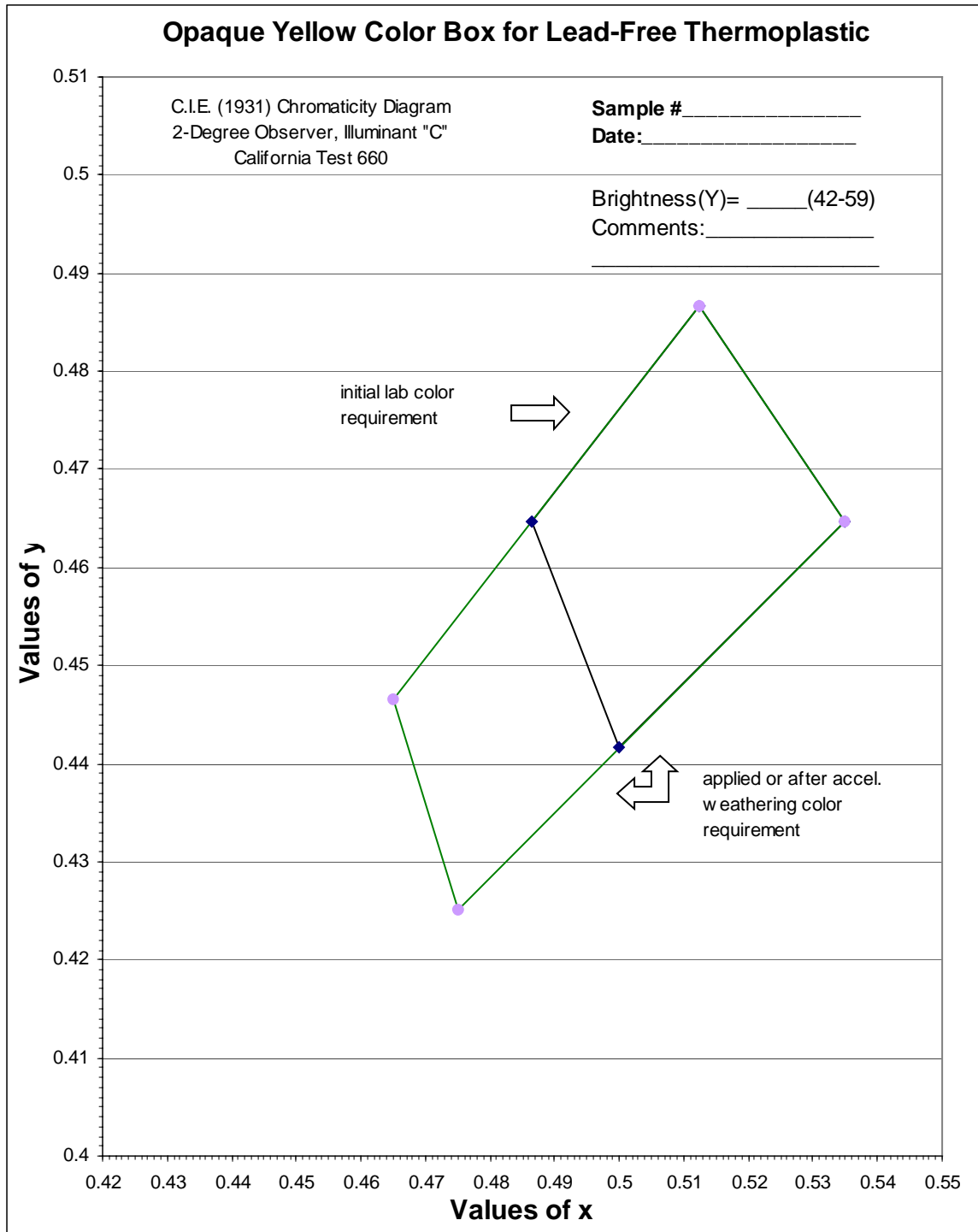


Chart for Plotting the Color of Yellow Thermoplastic

FIG. 9